A Mathematical Model For Facility Location in Reverse Logistics

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Abstract
Nowadays, consumption of materials for producing many goods at human life and rapid technological advances has driven organizations to address and make efforts to improve efficiency in their supply chain. Increasing efficiency in reverse logistics processes such as the recovery of the returned products or disposal of end-of-life products is one way in which firms attempt to maintain and increase competitiveness and market share. The volume and monetary value of product flowing in the reverse direction within the supply chain has been andcontinues to be increasing, particularly as environmental, legal, and customer service requirements increase throughout the marketplace.In this paper,after some explanation, a mathematical model is developed which minimizes the costs of setting upthe network and the relevant transportation costs.Thus,we seek to find a solution for optimized design of a reverse logistics network and the best recovery situation.Also in this article ,we use a case study numerical elements for validation of modle.

Keywords:
Supply chain management(SCM); Reverse Logistics(R.L); Facility Location Planning(F.L.P) ;Integrated Closed-Looped Supply Chain ;Remanufacturing and Reconstructing.

1-Introduction
Reverse logistics is the process of moving goods from their typical final destination to another point, for the purpose of capturing value or for the proper disposal of the products (Du & Evans, 2008).The volume and monetary value of product flowing in the reverse direction within the supply chain has been and continues to be increasing, particularly as environmental, legal, and customer service requirements increase throughout the marketplace (Guide Jr, Souza et al. 2006). It has been reported that the value of product returns in the commercial sector have exceeded$100 billion annually (Stock, Speh et al. 2002; Guide Jr, Souza et al. 2006). This processof returning products back through the supply chain is the reverse logistics process and it may encompass several different logistics activities. The number of scientific publications in the field of reverse logistics has been steadily growing, reflecting the increasing significance of this subject, mainly because of the growing environmental awareness.Product recovery options are multiform, including repairing, refurbishing, remanufacturing,cannibalizing, reconfiguration and recycling.

According to the American Reverse Logistics Executive Council, Reverse Logistics is defined as: “The process of planning, implementing,and controlling the efficient, cost effective flow of raw materials, in process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal”.(George Tagaras et al.,2008)This paper describes the remanufacturing logistics process which based on closed-loop supply chain management. Closed-Loop Supply Chain(CLSC) as a new logistics term had been put forward in 2003, But there has been no generally accepted definition(XIA Wen-hui et al,2011). Economical, social, and environmental dimensions are three main pillars of sustainable development.The environmental factors have been mainly taken into account in the developed countries, while in the developing countries the economical issues have been the main concern. Firms realize that the reverse channel is a target for gains in efficiency and reduction of costs.

Although different countries have their own regulations for recycling and disposal of by-products and waste, European legislation is generally believed to be more advanced. Remanufacturing is the process that

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